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OBSERVATIONS ON SOME NEW NODULATING LEGUME SPECIES FROM AZAD KASHMIR

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ABSTRACT

The legumes are well distributed in Pakistan and Kashmir, and Leguminosae ranks as the third largest family in order of abundance. In this paper, a cumulative list of newly reported nodulating legume species from Azad Kashmir is presented. The list comprises eighteen legume species distributed in four tribes: Desmodieae (five species within three genera), Galegeae (nine species within three genera), Indigofereae (one species within one genus), and Phaseoleae (three species within three genera). Observations were also made on the morphological features of the nodules.

KEY WORDS: nodulation, Leguminosae, taxonomy, Azad Kashmir

INTRODUCTION

The role of legumes in reclamation of degraded soils and in the improvement and revegetation of denuded and derelict ecosystems has been well documented (Brockwell *et al.* 1995; Thomas 1995). However, most studies included legumes of agricultural importance, whereas the use of wild legumes has been mainly restricted to the improvement of the productivity of marginal lands. Studies indicate that wild legumes and their associated rhizobia have great potential for increasing or restoring soil fertility (Thomas 1995; Singh & Mahma 1998). The global records of nodulation compiled by Allen & Allen (1981) show that only 15% of legumes have been examined at the species level. However, the percentage of legume species examined has risen to 20% during the last decade with the discovery of more nodulated legume species (Pueppke & Broughton 1999).

The legumes are well distributed in Pakistan and Kashmir, and Leguminosae ranks as the third largest family in order of abundance. Ali & Qaiser (1986) mentioned 107

genera and 539 legume species from Pakistan and Kashmir. Various researchers have made detailed surveys and have tremendously contributed to the studies on nodulation status of legumes of Pakistan and Azad Kashmir (Athar & Mahmood 1978, 1980, 1985, 1990; Nasim & Ahmed 1993; Nasim & Chaudhry 1993; Nasim *et al.* 1994; Mahmood & Iqbal 1994; Athar 1996a, 1997; Athar & Shabbir 1997). In this paper, a cumulative list of newly reported nodulating legume species from Azad Kashmir is presented (Nasim & Ahmed 1993; Nasim & Chaudhry 1993; Nasim *et al.* 1994). Observations are made on the tribal classification of the legume species, and morphological features of the nodules like size, shape, distribution, and color are also described.

MATERIALS AND METHODS

Legumes were surveyed for the presence of nodules from various parts of Azad Kashmir. Both wild and cultivated legumes were examined in their natural habitats at flowering time as described previously (Nasim *et al.* 1994). Legumes examined included weeds, herbs, shrubs, and climbers. At least five plants of each species were examined to minimize error. Nodules were distinguished from other kinds of pathogenic root malformation and many stubby root outgrowths (Truchet *et al.* 1989). In some cases, nodule smears and nodule slices were prepared and examined under the microscope (Somasegaran & Hoben 1994). Nodulation data were recorded and herbarium specimens were prepared for legume identification.

RESULTS AND DISCUSSION

A cumulative list of new nodulating legume species reported by Nasim & Ahmed (1993), Nasim & Chaudhry (1993), and Nasim *et al.* (1994) is presented in Table 1. The nomenclature and tribal classification are as described by Kirkbride (1986). The list comprises eighteen new nodulating legume species distributed in four tribes: Desmodieae (five species within three genera), Galegeae (nine species within three genera), Indigofereae (one species within one genus), and Phaseoleae (three species within three genera). Nodulation is reported in *Atylosa platacarpa* Benth. (Nasim & Ahmed 1993) and in *A. mollis* Benth. (Nasim *et al.* 1994). With the revision in the taxonomy of legumes, *Atylosa* is no longer accepted as a genus and was transferred to *Cajanus*. Nodules were observed for the first time in *A. mollis*, which according to the new classification has been renamed as *Cajanus mollis* (Benth.) van der Maesen.

Nodules were distributed on the main as well as lateral root systems, and were found in the upper 5-10 cm layer of soil. The majority of these species were abundantly nodulated under natural soil conditions, indicating distribution of a wide range of rhizobia in the soil. The shape of the nodules conformed mainly to globose to elongate types (Table 1). However, semi-globose and irregular shapes were also observed. They were usually 2-3 mm in diameter and up to several times longer. The nodules were generally smooth surfaced and occasionally had white fluffy streaks on their surface. These observations corroborate with Corby (1988), Mahmood & Iqbal

(1994), Athar (1996a, 1996b), and Athar & Shabbir (1997) who have described similar morphological features of nodules in various legumes. The size, shape, and color of the nodules varied for various species and sometimes at different stages of development, growth, and maturity. Nodules were mostly pink or brown with reddish interior, indicating their effectiveness in nitrogen fixation (Somasegaran & Hoben 1994).

It has been reported that about 20% of legume species and 57% of legume genera have been examined for nodulation (Pueppke & Broughton 1999). With growing interest in the survey of nodulation both in cultivated and wild legumes, the data would undoubtedly change rapidly in the near future with the discovery of new nodulating species.

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Table 1. Nodule morphology of some new nodulating legume species.

Species[a]	Plant Habit[b]	Nodule Color	Nodule Shape	Nodule Frequency[c]
DESMODIEAE				
Campylotropis meeboldii (Schindl.) Schindl.	V	light brown	globose	++
Desmodium motorium (Houtt.) Merr.	S	brown	globose	++
Lespedeza floribunda Bge.	S	brown	globose	++
L. juncea (L.*f.*) Pers. var. *juncea*	S	light brown	globose	+++
L. juncea (L.*f.*) Pers. var. *variegata* (Camb.) Ali	S	light brown	globose	++
GALEGEAE				
Astragalus alopecuroides L.	H	brown	elongated	++
A. chlorostachys Lindley	H	pink	elongated	++
A. hosackioides Benth. *ex* Baker	H	pink	elongated	+++
A. leucocephalus Grah. *ex* Baker	H	brown	elongated	+++
A. psilocentros Fisch.	S	pink	elongated	++
A. subumbellatus Klotzsch	S	light brown	elongated	++
A. trichocarpus Grah.	H	pink	elongated	+++
Gueldenstaedtia verna Georgi	H	brown	globose	++
Oxytropis mollis Royle	H	brown	globose	+
INDIGOFEREAE				
Indigofera heterantha Wall. *ex* Baker var. *gerardiana* (Wall. *ex* Baker) Ali	S	brown	globose	+++
PHASEOLEAE				
Cajanus mollis (Benth.) van der Maesen	V	light brown	elongated	+++
Flemingia fruticulosa Wall.	H	light brown	globose	+++
Rhynchosia pseudocajan Camb.	S	pink	globose	++

[a]: Species are arranged alphabetically within genera. Authors' citations are quoted following instructions of Brummitt & Powell (1992) as endorsed by the International Working Group on Taxonomy Database for Plant Science (TDWG).
[b]: Plant habit: H = herb; S = shrub; V = vine or climber.
[c]: Nodule frequency: + indicates 1 to 5 nodules per plant; ++ indicates 6 to 10 nodules per plant; +++ indicates more than 10 nodules per plant.

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